

## CHEMICAL COMPOSITION AND MEDICINAL PROPERTIES OF ROSE AND BARBERRY PLANTS

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**Abstract:** This article analyzes the chemical composition and medicinal properties of rose (*Rosa* spp.) and barberry (*Berberis* spp.) plants. It highlights the essential oils, flavonoids, organic acids, and vitamins present in rose petals, as well as the alkaloids, tannins, vitamin C, and other biologically active compounds found in barberry roots and fruits. The study discusses their traditional medicinal uses, including anti-inflammatory, antiseptic, calming, and immune-strengthening effects. The results provide scientific insight into the pharmacological importance of rose and barberry, emphasizing their potential as natural therapeutic agents and their established roles in traditional medicine.

**Keywords:** Rose, barberry, chemical composition, essential oils, alkaloids, flavonoids, tannins, medicinal properties, pharmacology, natural remedies.

**Introduction:** Medicinal plants have played a crucial role in human health and traditional healing practices for centuries. Among the vast diversity of botanicals used in natural medicine, rose (*Rosa* spp.) and barberry (*Berberis* spp.) hold a particularly important place due to their rich chemical composition and wide range of therapeutic applications. These plants are not only valued for their ornamental and nutritional qualities but also for the biologically active compounds that contribute to their pharmacological potential.

Roses have been cultivated for thousands of years for their fragrance, aesthetic value, and medicinal benefits. Their petals contain essential oils, flavonoids, phenolic acids, and vitamins that exhibit antioxidant, anti-inflammatory, and calming properties. Similarly, barberry is recognized as one of the oldest medicinal plants, traditionally used in various cultures for treating digestive disorders, infections, and inflammatory conditions. Its roots, bark, and fruits are rich in alkaloids—particularly berberine—tannins, organic acids, and numerous nutrients that contribute to its therapeutic activity.

In recent years, scientific interest in natural products and plant-based compounds has grown significantly due to increased demand for safe, effective, and environmentally sustainable alternatives to synthetic pharmaceuticals. The study of rose and barberry is especially relevant today, as both plants demonstrate strong potential for use in modern pharmacology, cosmetology, and preventive medicine.

This article aims to provide a comprehensive analysis of the chemical constituents of *Rosa* spp. and *Berberis* spp., as well as an overview of their medicinal properties supported by traditional knowledge and contemporary scientific research. By exploring their bioactive components and therapeutic effects, this work contributes to a broader understanding of the medical significance and potential applications of these two valuable plants.

**Materials and Methods:** Plant samples of rose (*Rosa* spp.) and barberry (*Berberis* spp.) were collected from naturally growing and cultivated areas during their respective flowering and fruiting seasons. Fresh rose petals and barberry fruits, along with roots and bark, were carefully

selected, cleaned, and dried under shade to preserve their chemical constituents. All samples were authenticated by a qualified botanist prior to analysis.

Dried plant materials were ground into fine powder using a laboratory grinder. Extracts were prepared using solvents of varying polarity, including distilled water, ethanol, and methanol, following standard maceration and Soxhlet extraction techniques. The extracts were filtered and concentrated using a rotary evaporator at controlled temperature to prevent degradation of heat-sensitive compounds.

Qualitative and quantitative phytochemical analyses were conducted to determine the presence of major chemical groups. Standard methods were employed to identify alkaloids, flavonoids, tannins, saponins, phenolic compounds, essential oils, and vitamins.

Gas Chromatography–Mass Spectrometry (GC–MS) was used to analyze volatile compounds, particularly essential oils extracted from rose petals.

High-Performance Liquid Chromatography (HPLC) was used to quantify flavonoids, phenolic acids, and alkaloids such as berberine in barberry samples.

Spectrophotometric assays (e.g., Folin–Ciocalteu method) were used to determine total phenolic and flavonoid content.

The biological activity of the extracts was evaluated through established *in vitro* assays: Antioxidant activity was measured using DPPH and ABTS radical scavenging methods. Anti-inflammatory potential was assessed using protein denaturation and membrane stabilization assays. Antibacterial activity was tested using the disc diffusion method against selected Gram-positive and Gram-negative bacterial strains.

All experiments were performed in triplicate. Data were analyzed using standard statistical software. Results were expressed as mean  $\pm$  standard deviation, and significance was evaluated using one-way ANOVA with a confidence level of 95%.

**Results:** The phytochemical screening of rose (*Rosa* spp.) and barberry (*Berberis* spp.) extracts revealed the presence of several biologically active compounds.

Rose petals showed high concentrations of essential oils such as citronellol, geraniol, nerol, and phenyl ethyl alcohol. Flavonoids (quercetin, kaempferol), phenolic acids (gallic acid, caffeic acid), and vitamins (notably vitamin C) were also detected in significant amounts.

Barberry samples—particularly from roots and bark—contained abundant alkaloids, with berberine being the dominant compound, followed by berbamine and palmatine. High levels of tannins, organic acids, and ascorbic acid were also observed in barberry fruits.

Both plants demonstrated notable antioxidant activity. Rose extracts showed strong DPPH and ABTS radical scavenging effects, correlating with their high phenolic content. Barberry extracts exhibited even higher antioxidant capacity, particularly in methanol extracts, likely due to their high alkaloid and phenolic concentration.

*In vitro* analysis showed that rose extracts significantly inhibited protein denaturation and stabilized red blood cell membranes, indicating anti-inflammatory potential. Barberry extracts showed comparable or stronger anti-inflammatory effects, especially those rich in berberine.

The antibacterial assay demonstrated that extracts from both plants inhibited the growth of various bacterial strains. Rose extracts showed moderate effectiveness against *Staphylococcus aureus* and *E. coli*, while barberry extracts exhibited strong activity against *S.aureus*, *E.coli*, and *Pseudomonas aeruginosa*, with inhibition zones proportional to berberine concentration.

All results were statistically significant ( $p < 0.05$ ). Triplicate measurements showed low standard deviation values, confirming the reliability of the experiments. Variations between solvent types indicated that methanol extracts yielded the highest concentration of active compounds and strongest bioactivity.

**Discussion:** The findings of this study confirm that both rose and barberry possess rich chemical profiles that contribute to their strong medicinal effects. The presence of essential oils, phenolic acids, and flavonoids in rose supports its traditional use for calming, anti-inflammatory, and skin-soothing purposes. These compounds are known to neutralize free radicals, reduce oxidative stress, and promote tissue regeneration, explaining its widespread application in cosmetics and aromatherapy.

Barberry demonstrated higher concentrations of pharmacologically active compounds, particularly berberine, which is well-known for its antimicrobial, anti-inflammatory, and antioxidant properties. The strong antibacterial activity observed in barberry extracts is consistent with previous studies showing berberine's efficacy against a broad spectrum of pathogens. The fruit's high vitamin C content further enhances its antioxidant potential, supporting its traditional use for boosting immunity and treating infections.

The anti-inflammatory results for both plants suggest potential therapeutic applications in the management of inflammatory disorders. However, barberry's stronger effect may be attributed to its alkaloid-rich profile, which interacts with inflammatory pathways more effectively than the primarily phenolic compounds in roses. Comparing the two plants, barberry exhibited generally stronger medicinal properties in most assays, while rose demonstrated milder but still significant activity, especially in antioxidant and anti-inflammatory tests. This suggests that while both plants have therapeutic value, barberry may be more suitable for direct medicinal use, whereas rose may be more appropriate for preventive health, cosmetics, and mild therapeutic applications. Overall, the results align with existing literature and provide further scientific support for the traditional uses of *Rosa* spp. and *Berberis* spp. Their high content of bioactive phytochemicals indicates strong potential for further research and development into natural pharmaceuticals and nutraceuticals.

**Conclusion:** The present study demonstrates that both rose (*Rosa* spp.) and barberry (*Berberis* spp.) possess a diverse and rich chemical composition that underlies their significant medicinal value. Rose petals contain essential oils, flavonoids, phenolic acids, and vitamins that contribute to notable antioxidant, anti-inflammatory, and mild antibacterial activities. These properties support the long-standing traditional use of roses in skincare, aromatherapy, and general wellness applications.

Barberry, on the other hand, exhibited stronger pharmacological effects, primarily due to its high content of alkaloids—especially berberine—as well as tannins, organic acids, and vitamin C. Its extracts showed potent antioxidant, anti-inflammatory, and antimicrobial activities, aligning well with its historical use in treating infections, digestive problems, and inflammatory disorders. The superior bioactivity of barberry suggests its potential for development into modern therapeutic agents or natural supplements.

Overall, the findings provide scientific validation for the traditional uses of both plants and highlight their potential in contemporary pharmacology and natural medicine. Further studies, including *in vivo* experiments and clinical trials, are recommended to fully explore their therapeutic applications, optimal dosages, and safety profiles.

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